

Claims:

1. A method for processing at least one microelectronic device comprising:
immersing at least a portion of at least one microelectronic device into a liquid bath provided within a vessel for performing a treatment on at least the immersed portion thereof;
separating the microelectronic device from the liquid bath by replacing said liquid with a gas environment adjacent to at least a surface portion of the microelectronic device; and
delivering a cleaning enhancement substance during said replacing, said cleaning enhancement substance causing a concentration gradient of said cleaning enhancement substance in liquid at an interface between the surface of the microelectronic device and the liquid bath to enhance fluid flow of from the microelectronic device surface,
wherein the delivery of the cleaning enhancement substance is varied during said replacing step.
2. The method of claim 1, wherein the delivery of cleaning enhancement substance is varied by changing a flow rate of delivery of cleaning enhancement substance from a first flow rate to a second flow rate.
3. The method of claim 2, wherein delivery of cleaning enhancement substance is further varied by changing a flow rate of delivery of cleaning enhancement substance from the second flow rate to a third flow rate.
4. The method of claim 2, wherein at least one flow rate is varied by increasing the flow rate.
5. The method of claim 4, wherein the separation is performed by lowering the liquid level within the vessel.

6. The method of claim 5, wherein the liquid level is lowered below the at least one microelectronic device and the delivery of cleaning enhancement substance is continued while the liquid level is lowered further.
7. The method of claim 6, wherein a quick dump of remaining liquid is conducted at a point after the liquid level is lowered below the at least one microelectronic device while cleaning enhancement substance is delivered.
8. The method of claim 7, further comprising a step of drying the at least one microelectronic device by supplying at least one gas stream directed within the vessel to dry a surface of the at least one microelectronic device, and wherein delivery of cleaning enhancement substance is continued for at least an initial portion of the drying step.
9. The method of claim 1, wherein the delivery of cleaning enhancement substance is varied by changing a concentration of the delivery of cleaning enhancement substance from a first concentration to a second concentration.
10. The method of claim 1, wherein the cleaning enhancement substance is delivered into the vessel at a concentration of between 0.5 percent and 3.6 percent within a carrier gas.
11. The method of claim 10, wherein the cleaning enhancement substance comprises IPA and the carrier gas comprises nitrogen.
12. A method for processing at least one microelectronic device comprising:
immersing at least a portion of at least one microelectronic device into a liquid bath provided within a vessel for performing a treatment on at least the immersed portion thereof;

separating the microelectronic device completely from the liquid bath by replacing said liquid with a gas environment adjacent to the microelectronic device; and delivering a cleaning enhancement substance during said replacing, said cleaning enhancement substance causing a concentration gradient of said cleaning enhancement substance in liquid at an interface between the surface of the microelectronic device and the liquid bath to enhance fluid flow of from the microelectronic device surface,
wherein the delivery of the cleaning enhancement substance is continued after said replacing step is complete relative to the microelectronic device.

13. The method of claim 12, wherein the separation is performed by lowering the liquid level within the vessel.
14. The method of claim 13, wherein the liquid level is lowered below the at least one microelectronic device and the delivery of cleaning enhancement substance is continued while the liquid level is lowered further.
15. The method of claim 14, wherein a quick dump of remaining liquid is conducted at a point after the liquid level is lowered below the at least one microelectronic device while cleaning enhancement substance is delivered.
16. The method of claim 15, further comprising a step of drying the at least one microelectronic device by supplying at least one gas stream directed within the vessel to dry a surface of the at least one microelectronic device, and wherein delivery of cleaning enhancement substance is continued for at least an initial portion of the drying step.
17. The method of claim 12, wherein the delivery of the cleaning enhancement substance is varied during said replacing step.

18. The method of claim 17, wherein the delivery of cleaning enhancement substance is varied by changing a flow rate of delivery of cleaning enhancement substance from a first flow rate to a second flow rate.
19. The method of claim 18, wherein delivery of cleaning enhancement substance is further varied by changing a flow rate of delivery of cleaning enhancement substance from the second flow rate to a third flow rate.
20. The method of claim 19, wherein at least one flow rate is varied by increasing the flow rate.
21. A method of drying a plurality of microelectronic devices, the method comprising the steps of:

supporting a plurality of microelectronic devices in a drying environment such that the microelectronic devices are provided in a substantially directional arrangement at a predetermined spacing; and

directing plural gas streams toward the arranged microelectronic devices such that at least one gas stream is directed between adjacent microelectronic devices of the arranged plurality of microelectronic devices.
22. The method of claim 21 further including a step of separating the plurality of microelectronic devices from a processing fluid wherein the plurality of microelectronic devices are provided in a the same arrangement at a predetermined spacing.
23. A method of drying a plurality of microelectronic devices, the method comprising the steps of:

supporting a plurality of microelectronic devices in a drying environment such that the microelectronic devices are provided in a substantially directional arrangement at a predetermined spacing arranged;

directing a first gas curtain toward the arrangement of microelectronic devices at a first angle of incidence with respect to the arrangement of microelectronic devices; directing a second gas curtain at an angle of incidence with respect to the arrangement of microelectronic devices that is different from the angle of incidence of the first gas curtain; and

directing a third gas curtain at an angle of incidence with respect to the arrangement of microelectronic devices that is different from the angle of incidence of the first gas curtain.

24. An immersion processing apparatus for processing a plurality of microelectronic devices, the apparatus comprising:
 - a vessel for containing a liquid immersion bath and for receiving a plurality of microelectronic devices to be positioned within the immersion vessel by support structure providing the microelectronic devices in a substantially directional arrangement at a predetermined spacing; and
 - a gas dispenser operatively positioned relative to the vessel and connectable to a pressurized supply of drying gas and for providing plural gas streams to a plurality of arranged microelectronic devices when positioned within the vessel such that at least one gas stream will be directed between adjacent microelectronic devices of the plurality of arranged microelectronic devices.
25. The apparatus of claim 24, wherein the gas dispenser provides a gas curtain to a plurality of arranged microelectronic devices as they are positionable within the vessel such that the gas curtain can be provided at a predetermined angle of incidence with respect to the arrangement of the microelectronic devices when positioned within the immersion vessel.
26. The apparatus of claim 25, wherein the gas curtain comprises a plurality of gas streams.

27. The apparatus of claim 26, wherein the plurality of gas streams are provided so that at least one gas stream is directed between adjacent microelectronic devices of the plurality of microelectronic devices.
28. An apparatus for drying a plurality of microelectronic devices, the apparatus comprising:
 - a vessel for containing a liquid immersion bath;
 - a support means for positioning microelectronic devices in a substantially directional arrangement at a predetermined spacing within the immersion vessel;
 - a first gas dispenser operatively positioned with respect to the support device and connectable to a pressurized supply of drying gas and for directing a first gas curtain at a first angle of incidence with respect to the arrangement of the microelectronic devices when positioned on the support means;
 - a second gas dispenser operatively positioned adjacent to and spaced from the first gas dispenser and connectable to a pressurized supply of drying gas and for directing a second gas curtain at a second angle of incidence with respect to the arrangement of microelectronic devices that is different from the first angle of incidence of the first gas curtain; and
 - a third gas dispenser operatively positioned adjacent to and spaced from the first gas dispenser and opposite the second gas dispenser and connectable to a pressurized supply of drying gas and for directing a third gas curtain at a third angle of incidence with respect to the reference plane that is different from the first angle of incidence of the first gas curtain.
29. The apparatus of claim 28, wherein the first gas dispenser is located centrally of both the second and third gas dispensers.